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Information concerning the following considerations in the selection of carpeting for educational facilities is given--(1) characteristics of face yarns, pile, backing and underlayment, (2) carpet construction, (3) acoustical properties, (4) heat transfer properties, (5) fungistatic and bacteriostatic characteristics, (6) cost, and (7) maintenance. A selective bibliography containing books related to carpeting, cost comparison and carpet maintenance is included. (FS)

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A COMPENDIUM ON CARPETING

IN OUR FUTURE

By

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A Paper
Presented to
The Central States Regional Association
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SELECTING CARPETING

In order to select and/or explicitly specify carpeting with knowledge, one must know of what materials carpeting is composed and how it is normally constructed. In order to explore carpeting construction in a manner which will have some system and merit, the following segments will be covered individually: characteristics of face yarns, pile, backing and backing yarns, underlayment, and the individual types of carpet construction.

CHARACTERISTICS OF FACE YARNS

BULK CONTINUOUS FILAMENT NYLON

This type of face yarn has had the highest poundage cost of all commonly used carpet fibers. Cost in relationship to performance is very low; however, it has unexcelled abrasion resistance, is extremely stain resistant, and does not shrink. It is washable, mothproof and non-allergenic. It does not pill, fuzz, or shed. Fiber quality uniformity is excellent. Delivery of bulk continuous filament nylon carpets presents no problem. Continuous filament nylon yarn has the disadvantage of a slight surface gloss so that it is not as rich in appearance as some other fibers. Some advantages are the following: ultimately, it should be cheaper to go directly from extruded filament to finished yarn bypassing the many handling operations involved in staple spinning, fewer knots in the yarn can lead to less processing cost and better overall quality in the carpet, the finished fabric should have a minimum of hairiness which leads to greater clarity in appearance and better retention of appearance with use, greater uniformity in yarn size should eliminate thick and thin yarn streaks.

Chemically there are two types of nylon, those termed type 6 and those termed type 6,6. Nylon 6 melts at from 415° to 430° Fahrenheit, while Nylon 6,6 melts at around 480° Fahrenheit. The flame of a match is well over 1,000° Fahrenheit, and hot tobacco ashes are well over 500° Fahrenheit; this means any nylon used in a carpet will melt when either matches or cigarettes, etc., are dropped on it.

Nylon is structurally a hard, shiny surfaced fiber, which will become scratched over a period of time by normal gritty type soil. This scratching will cause roughness, which will hold the dusty soil. High static electricity generation is another tendency, and the static charge will attract the dusty soil to the fibers; therefore, as a nylon carpet ages, you can expect it to require more frequent cleaning. Nylon can be blended with wools and acrylics to reduce surface gloss. Filament nylon should be continuous filament, high bulk or textured carpet-type yarn. Individual filament size should be at least 15 denier.

Material specifications for staple nylon should require the use of carpet-type fiber, with average fiber diameter of 15 denier or higher, with a minimum requirement of 85 per cent virgin fibers.

ACRYLIC-MODACRYLIC FIBERS

Acrylics have had the second highest poundage cost among carpet fibers. Yarn cost per pound is slightly higher than wool, but its superior bulking characteristics make it more economical in terms of construction durability, i.e.,the same density can be achieved with less yarn weight. Its abrasion resistance is comparable to top quality wool. It has excellent stain resistance, does not shrink, and is mothproof and non-allergenic. It is washable

but does have a greater tendency than wool toward pilling and beading. Since the acrylic fibers strength is less than nylon, pilling is not as serious a factor for acrylics. When pills form, they usually wear off after moderate traffic. Long staple acrylics (approximately seven-inch fiber length) have less tendency to pill and fuzz than short staple (three to four inch fiber length) acrylics, because fewer fiber ends are exposed.

Modacrylic fiber is, as the name indicates, a modified acrylic fiber with slightly better bulking characteristics, among other advantages. Acrylics, due to their low gloss surface, present a much richer appearance than nylon and maintain this appearance longer due to the soiling effects of nylon as it ages. The appearance of Acrilan yarn is very similar to that of dyed wools, but its stain resistance, crush resistance, and, of course, shrinkage resistance, are superior to wool, and its non-allergenic quality makes it acceptable in areas where wool would not be practical. Acrylics should not, as yet, be specified in a solid color, for the yarn does not have the affinity for dyes that wool and nylon possess and may show streaking. Always specify acrylics in a blend of colors.

The acrylics stick between 400-500^{o} Fahrenheit and burn readily. The modacrylics, while flame resistant, soften and deteriorate at approximately 300^{o} Fahrenheit. Since acrylics are considerably more flammable than wool, they are usually blended with modacrylics or with wool and nylon for commercial grade carpets. Material specifications should call for carpet-type fiber, with average fiber diameter of 15 denier or higher. At least 85 per cent virgin fibers should be required.

WOOL

Wool is still considered the traditional carpet fiber. While much less expensive than bulk continuous filament nylon and slightly less than acrylics in terms of poundage price, wool is more expensive than either fiber in relationship to its performance, and wool prices are much less stable than those of man-made fibers. Wool bulking characteristics are not as good as either nylons or acrylics. Abrasion resistance is comparable to acrylics. Since it is a natural fiber and has a rather high water content, it becomes absorbent and susceptible to deep staining when the fiber is dry. It will water spot, shrink, fuzz and shed. Wool may be detergent shampooed on location or soap or detergent cleaned in a cleaning plant. It is not inherently mothproof, but may be superficially mothproofed. It is customary to specify that the wool pile component be treated with a moth repellent, such as a silicofluoride compound. There is a wide range of fiber quality in wool, which becomes difficult to control in specifications. All wool used in carpeting is imported, and wool from each country has its unique qualities as to those even within a country or from different years. Wool carpets that have been equal in every respect have been known to have shown variances of up to 35 per cent in abrasion resistance under Taber Test. I have never heard of anyone who can determine the various wools that go into a carpet after the carpet is blended. The only manner of assuring the best quality is to test samples of identical specification.

An identifying characteristic of wool is that it burns slowly and extinguishes quickly and without smoldering. Burned wool leaves a crusty ash and emits an odor similar to scorched feathers while the man-made fibers have a tendency to bead when heated. Material specifications should call for thoroughly scoured carpet-type fiber. Only virgin fibers or fibers recovered from the carpet yarn manufacturing process should be used with a minimum of 85 per cent of virgin fiber.

OTHER YARNS

Rayon, Cotton, and Acetate will not be covered in this discussion because of their poor characteristics. It is not recommended that they be used as the face pile for any commercial carpet.

In general, blends of fibers can be expected to behave according to the proportion of each fiber type present in the blend. With the new man-made fibers and the natural fibers, there are many opportunities for interesting textures and blends and resulting better values.

In the future, we can expect better and cheaper man-made fibers for carpeting face yarns. Every month or so, one hears of a new type carpet on the market. Often as not, the fiber is the "same old stuff" with a different brand name.

PILE

Pile is the raised loops on the surface of a carpet, whether they are cut or uncut. Pile, in other words, is what you see when you look down upon a carpet's surface.

Pile height is the length of the pile yarns from the top of the pile to the top of the backing; it does not include the thickness of the backing. Pile height is measured in thousandths of an inch. There are two distinct trains of thought on pile height; one thought is that pile height is relatively immaterial with regards to wear, the other is just the opposite, in that the higher the pile the longer the expected service wear. Both are in agreement that the density and all other factors must be equal when considering pile height. I tend to think, however, that pile height should be directly proportional to the pile density, for the greater the density of the carpet the more common support for each pile yarn, and the less it will be subjected to crushing and bending. Whatever the thought, all seem to be in agreement that pile height should never be less than .200 inch nor greater than .400 inch for heavily traveled areas. Luxury suites may go to greater pile height; however, I can think of no instance when it would be advisable to go below the minimum.

Two problems must be considered in deciding whether to use loop or cut pile, these problems are soil and snagging. Cut pile does not snag, therefore, it would be a waste of face yarns to weave them through the backing; however, some face yarn (all of which is the basis for the price) is discarded in shearing the carpet face. When a carpet is woven of a yarn that has a tendency to pill, fuzz, or shed, that tendency becomes more pronounced in cut pile. Because of its smooth, even texture, cut pile shows soil more readily that loop-pile carpet. In areas subject to heavy soiling, it should be

specified in a pattern rather than a solid color. The frayed yarn ends of a cut pile tend to absorb liquid (stains) more readily than the uncut fibers of a loop pile carpet.

Loop pile carpet, if lacking in surface density, does snag. If it is sufficiently dense, however, this problem can be overcome. Loop pile has less tendency to pill, fuzz, or shed than equivalent constructions with cut pile. Because of its heavier texture and less exposed yarn ends, it absorbs and shows less dirt and stains. Loop pile carpet intended for use in heavy traffic areas should be woven through the backing, regardless of its density. Round wire loop-pile carpet will outwear equivalent cut-pile constructions by approximately one-third.

The ply and yarn size is also to be considered inthe carpet's pile yarn. A ply of pile yarns is the number of single yarns twisted together, the pile yarn of two or three is most preferable. The weight or thickness of a single strand of yarn is also a factor of quality. Two methods of determining weight are: woolen count, or the actual number of yards of yarn per ounce; and denier, or the number of grams weight per 900 meters of yarn. Ply of yarn in itself is not really an indication of quality without considering the weight or size of yarns twisted into the ply.

Carpeting should actually be purchased by, among other things, the weight of pile yarn per square yard. When considered with pile height, the weight of pile yarn will give a fairly good indication of the quality. Weight of pile yarn per square yard is, however, dependent upon the carpet construction, the weight of the yarn, and the pile height. This is a relative measure of density.

PILE DENSITY

The denser the pile, or in other words, the more tufts per square inch of surface of equal yarn size, the less crushing weight each tuft must bear. Pile density is usually a calculated figure derived from the rows or wires, the weight of the pile yarn, and the pitch. Density is normally calculated by the following formula:

$$D = 2RPB \quad \text{where}$$

D is the density of the pile

R is the number of rows per inch lengthwise

P is the widthwise pitch

B is the weight of the pile yarn in grains per inch.

The pitch is the number of warp (lengthwise) lines in a 27-inch width of carpet. When we speak of a 180 pitch rug, we mean that there are 180 lines of yarn running lengthwise to the carpeting in every 27 inch width of carpeting. However, pitch does not have any significance for tufted or knitted carpets because they are not of woven construction.

The rows or wires per inch are the number of weft yarn shots in the crosswise direction measured in quantity per inch of unit length of a carpet, or simply the number of pile tufts per inch of length of the carpet. Rows vary with types of weave and quality of the carpet, as does pitch. The greater the pitch and rows per inch, the tighter the weave. Rows are measured by marking three inches lengthwise on the back of a piece of carpeting, then count the number of rows or wires within the lines and divide by three. Rows have no significance for tufted or knitted carpets.

BACKING

Backings are made of various yarn fibers, and as may be suspected, the stronger the backing yarn fibers, the stronger the carpet and the longer the ultimate life. Backing gives the carpet horizontal strength against tearing and also is necessary to hold the face pile. The more fibers the backing contains, the longer life expectancy of the carpet. A method of increasing the number of backing fibers is to add stuffers of heavy yarns running the length of the carpet. The usual backing yarns employed are cotton, rayon, jute, kraftcord, wool, and nylon.

Kraftcord is a twisted yarn made from "Kraft" paper. It is used as an alternate for cotton or jute in carpet backing, and is often used as a "stuffer". Its one advantage is that it is reasonable in cost.

Jute is a spun sisal yarn and is the most common yarn used in woven carpets. A woven jute burlap is generally used as the backing fabric for tufted carpets.

Cotton is normally used as a "stuffer."

Nylon and rayon are coming into their own as backings for more commercial carpets, as washability requirements increase. Of course, these yarns are highly moisture resistant and not subject to rot or mildew.

Wool is used as a backing primarily in chenilles and other expensive quality carpetings and is probably the most expensive backing yarn.

Nearly all commercial carpets are coated on the back with latex. This seals the tufts, so to speak, and when tufted carpets are sealed, you need not worry about tufts pulling out. This sealing coat also permits cutting of a clean edge in all directions with less possibility of ravel, therefore making binding unnecessary. Scrim, a woven mesh fabric bonded to the backing with latex, is often used to increase dimensional stability, especially in tufted and knitted carpets.

UNDERLAYMENT

There will be only two types of underlayment, hereinafter referred to as padding, considered in this paper. The two types will be the hair or jute-type pads and sponge rubber. Do not get involved with synthetic foam pads. So far they have been very undesirable.

Felted pads of hair or jute will mat down with use and thus lose some of their resiliency as well as thickness. Felted pads are also prone to staining the carpeting above when soaked. It is wise to test felted pads for staining before buying. Felted pads are recommended for use over wooden floors.

Sponge rubber padding has a disadvantage of clinging, thus causing difficulty in stretching. Some carpets are sold commercially with sponge rubber bonded to the carpet backing, and this is highly recommended for installation on concrete floors wherein the sponge rubber is just cemented to the concrete surface. Sponge-bonded carpet never needs restretching, whereas broadloom carpeting installed on a separate pad usually required a minimum of one re-stretching after installation.

If cigarette burns occur or stained areas need repair, the sponge-bonded carpet is probably the easiest to repair, requiring only that a plug be cut out and a new swatch cemented in its place. Broadloom carpets installed over pads usually must be "pulled up" and the damaged area removed and a replacement swatch sewn into the carpet from the back. This requires a craftsman. Another method is to insert a plug and cement it to the carpet by the means of an adhesive seam tape. This does not require the carpet to be pulled up, but does occasionally result in a visible patch. The adhesive seam tape method requires much less skill.

CARPET CONSTRUCTION

There are three basic types of carpet construction: woven, knitted, and tufted. All are broadloom in that they may be obtained in widths of 54" or greater. In the woven carpets there are the Velvet, Wilton, and Axminster types.

VELVET

The velvet weaving operation is comparatively simple. Pile and backing yarns are alternately raised and lowered while the shuttle, which moves back and forth across the loom, binds the yarn with jute or cotton thread. The pile is formed by strips of steel, called "wires," which are inserted between pile yarns and warp during weaving. The height of the wire determines the depth of the pile. The wires are withdrawn, of course, after several rows are woven, or enough carpet has been woven to bind the pile yarns securely. Velvet carpeting is available in both cut and loop pile. To obtain cut pile, a razor edge is attached to the wire's end and the pile is cut as the wire is withdrawn. A high quality velvet has 8 to 10 wires per inch and a pitch of 216 to 270. This is 64 to 100 tufts per square inch.

WILTON

The Wilton weaving method differs from a velvet loom in that it has a Jacquard mechanism. This mechanism permits the weaving of patterned carpet of multiple colors, usually limited to five, or one color for each frame of yarn on the loom. By a system of punched cards the loom determines which color yarn the mechanism will lift to the surface and loop over the wires, and which it will leave to be buried in the body of the carpet. Depending on the carpet color and pattern, there may be anywhere from one to four strands of yarn beneath the face of the carpet for each tuft of yarn showing

on the surface. Pitch of Wiltons can range from 162 up to 256, while wires per inch generally range from six to ten. Very good Wiltons range up to about 125 tufts per square inch. A one-frame or solid color Wilton is identical to a velvet carpet and is considered as such. A dense low-pile Wilton of a given pile yarn weight will generally give better service life than a deep-pile, low-density Wilton of the same back construction and pile weight.

AXMINSTER

The Axminster carpets are made on looms which draw pile yarns from small spools wound with the various colored yarns to be used in the carpet. The sequence of the colored yarns on the spools determines the surface pattern. The spools are positioned on an overhead conveyor which brings the spools down to the loom. As each row of spools arrives in place, the loom inserts and cuts a row of pile tufts from the strands of yarn on the spool. Because of the nature of the loom, the texture of a conventional Axminster carpet is usually limited to a cut-pile, even-level pile height. A variation in pile height can be obtained by using specially treated yarns which "shrink" after steaming. Axminster carpeting can generally be identified by the following features: the back of the carpet has a double weft, the back is usually very stiff due to the double shot and can be rolled one way only, they usually have even pile height and always are of cut pile. Most Axminster carpets have a standard pitch of 189; a maximum of 216 is also used. Top quality Axminster may have as many as 8 to 11 rows per inch. This combination of rows and pitch results in approximately 56 to 77 tufts per square inch.

KNITTED CARPETS

Knitting differs from weaving, because the carpets are made by looping the pile and backing yarns together with different sets of needles on a large machine. Currently, most knitted carpets are of looped pile texture, available either in solid colors or tweeds. Pile height of the loops can be varied to create textural designs. Cut pile can be achieved by a shearing operation. You can identify a knitted carpet by bending the carpet to expose the backing, then looking for the continuous looping of the pile yarns from row to row. A coating of latex is normally used on knitted carpets to provide additional body.

TUFTED CARPETS

Tufting is one of the new important methods for making carpets. In operation, the tufting machine behaves like a giant sewing machine with hundreds of needles. A yarn threaded through each needle eye is moved through a backing fabric. As the needle is pulled out, a loop or tuft is formed and held by the backing fabric. A heavy coating of latex is, and must be applied to the back of the fabric to anchor the tufts permanently in place. The quality of tufted carpets depends upon a number of factors, including: yarn quality, amount of pile yarn per unit area, quality of backing material, and thickness and quality of the coating applied to the carpet. All good tufted carpets have reinforced backing with a minimum of four ounces of fabric. The weight of latex coating varies from 12 to 28 ounces per square yard. A high quality tufted carpet has seven to ten stitches per inch of length, up to eight needles per inch (56 tufts to 80 tufts per sq. in.), and backing fabric

weighing 12 to 13 ounces per square yard. The pre-formed backing fabric has generally been made of jute, although cotton canvas and other new backing fabric materials are now also used and are in the process of being developed.

The foregoing paragraphs on materials and types of carpeting are not meant to be complete in detail, but are background information only for those entering into the use of carpeting. It is suggested that those who are anticipating using carpeting consult with a manufacturer's agent for help in obtaining the right carpet specification for the space use, and for help in ascertaining whether carpet samples submitted with bids meet the specifications.

ACOUSTICAL PROPERTIES

The acoustical values of carpeting are somewhat readily apparent. In addition to the physical absorption of sound and reduction of impact noises, carpeting tends to induce people to speak more softly and conduct themselves with greater dignity. This final observation may be contingent upon the fact that in this era carpeting is still considered primarily as a luxury item. As commercial applications of carpeting increase, the present respect for carpeting may decrease to the level of the present respect for resilient tile floors.

The two main points in carpet acoustics, the reduction of impact noises and the physical absorption of sound, can negate or lessen the need for other sound control devices in areas where carpeting is used. This can often provide a substantial savings in the first cost of a structure if properly planned and designed.

There have been some tests conducted by the American Carpet Institute to aid acoustical engineers and architects in their planning structures using carpeting as a sound control device. The tests as they were set up fell into three main categories:

1. Determination of carpets noise reduction coefficients.

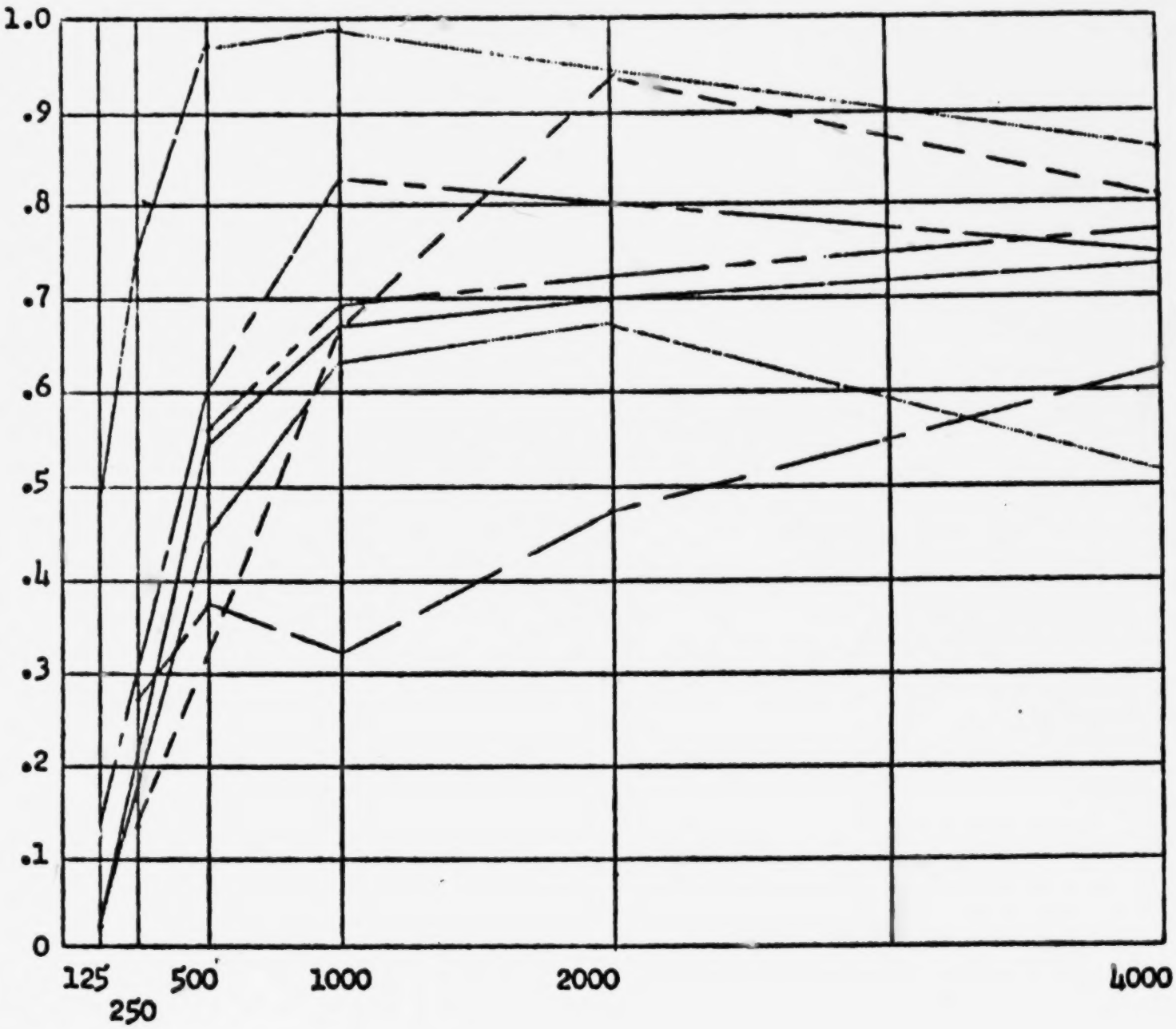
2. Determining how various characteristics of carpet construction and installation affect its sound absorption.

3. Determining whether carpet reduces impact noises significantly.

The results indicate that four out of five of the carpets tested on 40-ounce hair felt underlays had a range of performance equal to many acceptable acoustical materials -- a noise reduction coefficient of .50 to .60. The carpets average NRC was .55.

The following is a figure showing a plot of the frequency in cycles per second versus the sound absorption coefficient for five carpets, also plotted on this curve are the hi-low absorption values for all AMA manufactured perforated cellulose fiber tile. It can be seen from this first series of tests that carpeting falls predominately within the range of correction of perforated cellulose fiber ceiling tile. (Fig. 1).

FIGURE 1
SOUND ABSORPTION COEFFICIENTS VERSUS FREQUENCY
FOR CARPETING AND FIBER ACOUSTICAL TILE



FREQUENCY IN CPS

_____ Sound absorption results of four carpets

_____ High and low sound absorption values for all AMA manufactured perforated cellulose fiber tile

The second series of tests was run to determine the effect of the type of carpet and underlays on absorption coefficients. The following were the results:

1. Density of pile is an important factor. In principle the more dense the pile, the greater the absorption of sound. This is especially true at the lower frequencies. The following graphical figure (Fig. 2) of the test results does not prove this throughout the frequency range tested; however, it does verify the theoretical conclusion up to 1,000 CPS.

2. Depth of pile also makes substantial differences in absorption efficiency. The deeper the pile the greater the absorption of sound (Fig. 3).

3. Underlays increase the sound absorption of all soft floor coverings substantially, as you may observe in the following curve showing the effect of underlay thickness upon sound absorption. (Fig. 4)

Backing materials make very little difference, heavily starched and more particularly, latex backing increase sound absorption efficiency at low frequencies and decrease high frequency absorption. Pile structure, cut pile, loop pile, etc., seems to have little effect on a carpet's sound absorption. Type of fiber used in both pile and backing material also make very little difference.

The net results indicate that for a carpet with the highest sound absorption characteristics, you should obtain one having a deep dense pile, and this carpet should be installed over a good underlay, the thicker the better for acoustical properties.

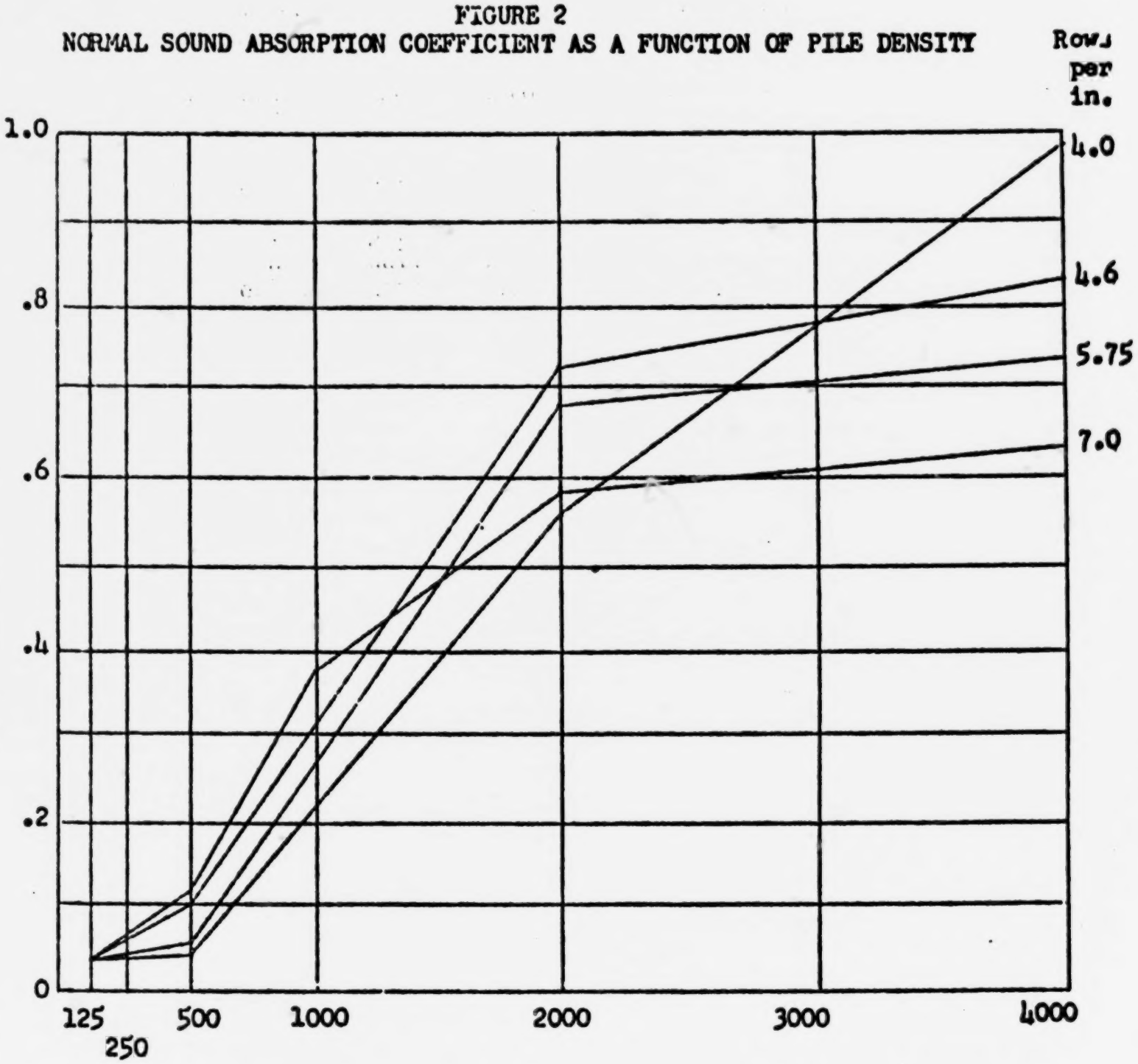
Some acoustical engineers claim quite justly that carpeting is better than acoustical tile for classrooms, because it absorbs sound where it is most usefully absorbed, on the floor. The hard surfaced ceiling then reflects the sound to the students from its source, in most cases the instructor, to the furthest extremity of a normal classroom. Acoustical ceiling tile serves as an acoustical treatment by absorbing all sounds, those eminating from the instructional source as well as background noises.

Carpeting does not have to absorb all sounds, for its location and cushioning effect reduces floor impact noises to a minimum.

In reporting on their tests of the reduction of impact noises by carpeting, the American Carpeting Institute reports in principle only because their decibel readings apparently lack comparability. No tests are needed to say that carpeting virtually eliminates most floor impact noises produced by clicking heels, scraping chairs, dropping pens, etc.

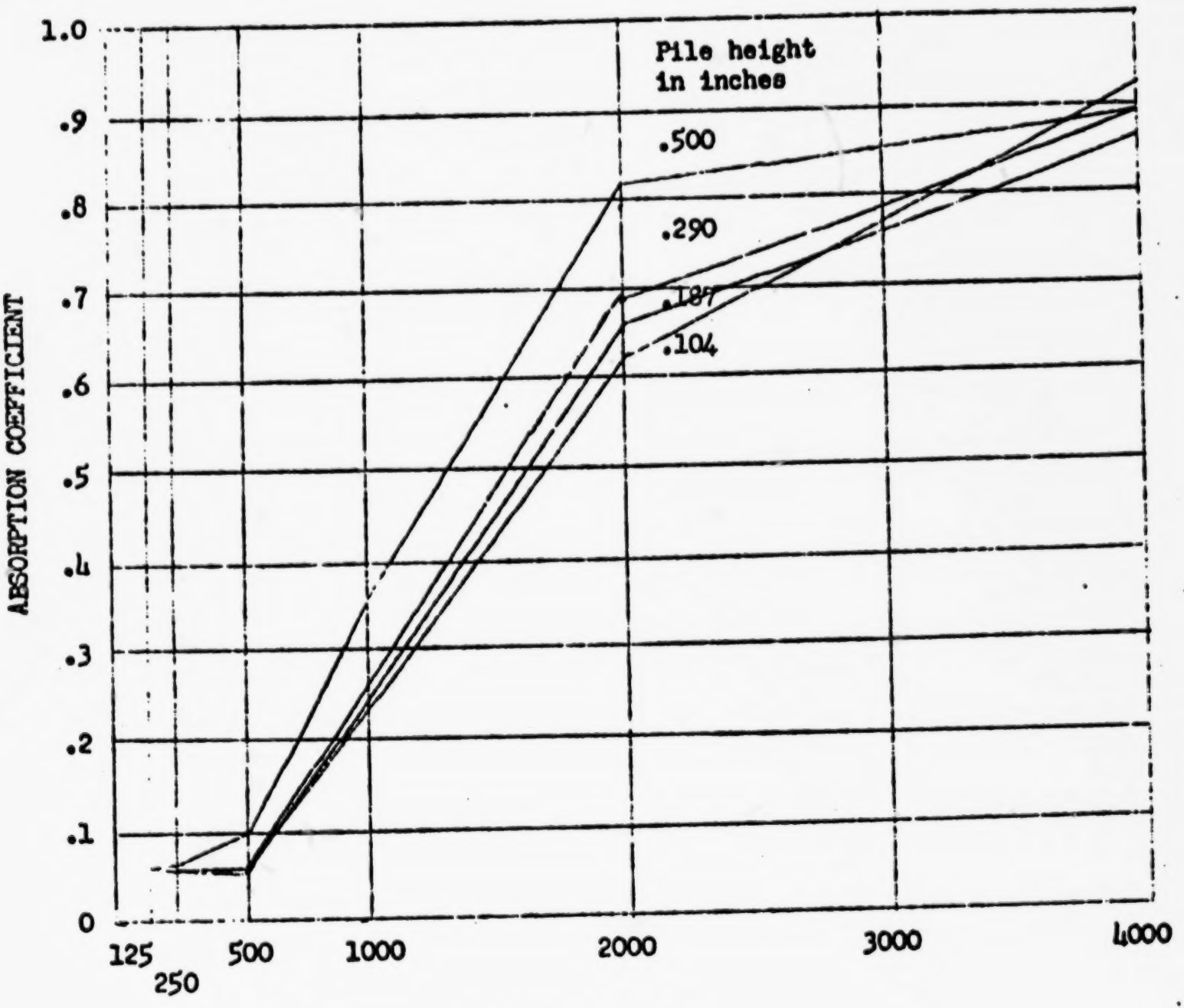
FIGURE 2

NORMAL SOUND ABSORPTION COEFFICIENT AS A FUNCTION OF PILE DENSITY



Normal sound absorption coefficient as a function of pile density for carpets having the following constants: pitch 189; fiber content, wool; type, Axminster; average pile thickness, 0.26 in.; average pile weight, 20.5 oz. per sq. yd.; average total weight, 46.0 oz. per sq. yd.

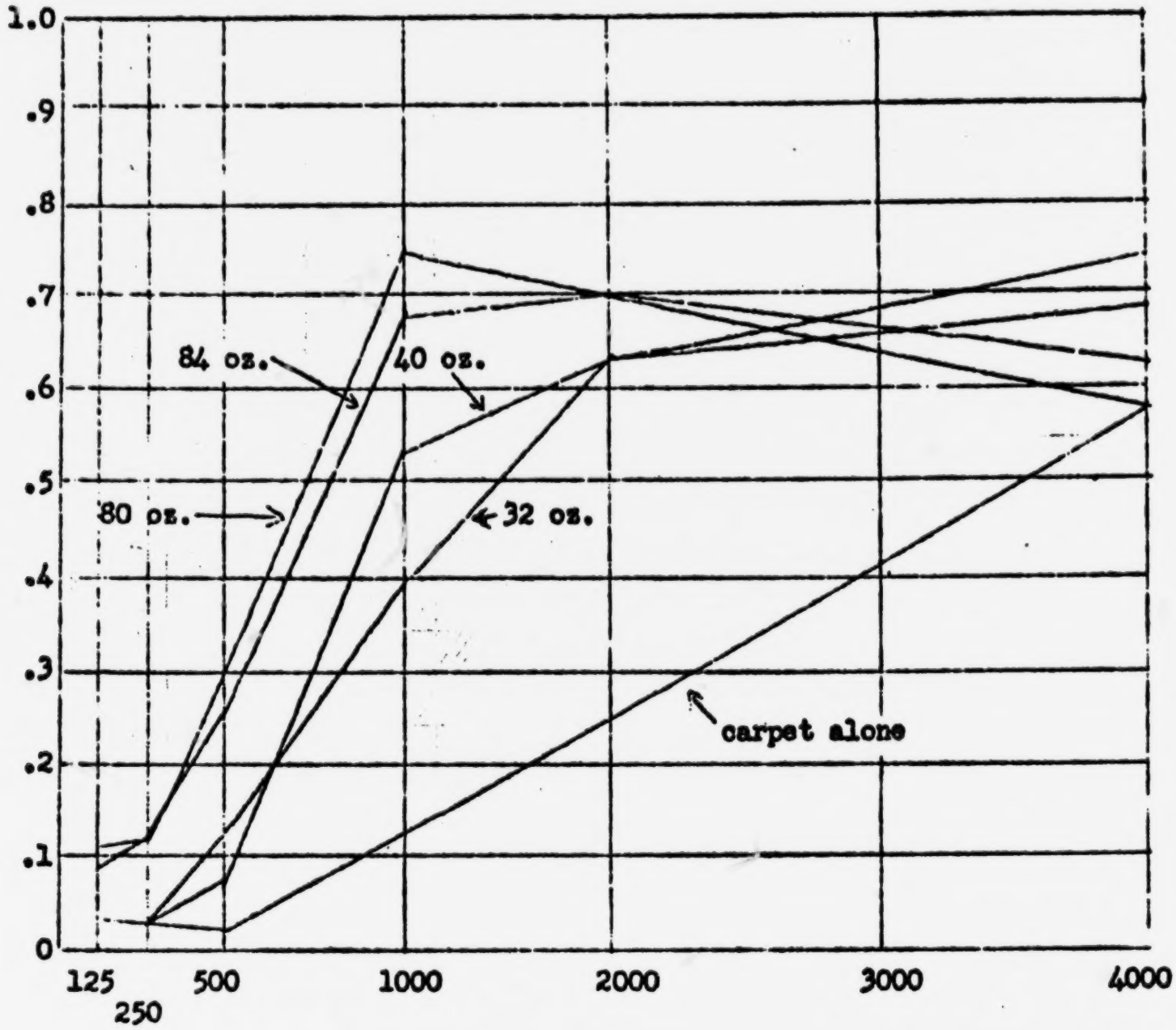
FIGURE 3
NORMAL SOUND ABSORPTION COEFFICIENT AS A FUNCTION OF PILE THICKNESS



Normal sound absorption coefficient as a function of pile thickness for carpets having the following constants: pitch, 196; rows per in., 8.5; fiber content, 100% wool; type of weave, Velvet; average pile thickness, 0.33 in.; average pile weight, 38.8 oz. per sq. yd.; average total weight, 63.2 oz. per sq. yd.

FIGURE 4

NORMAL SOUND ABSORPTION COEFFICIENT AS A FUNCTION OF UNDERLAY THICKNESS



Normal sound absorption coefficient as a function of underlay thickness for a 100% wool carpet of the Axminster type having the following constants: pitch, 189; rows/in., 7.0; pile thickness, 0.28 in.; pile weight, 25.7 oz/sq. yd.; total weight, 60.4 oz./sq. yd.

HEAT TRANSFER

The American Carpet Institute is of the belief that some and possibly considerable savings can be realized by reduction in energy consumption as a result of the insulating properties of carpeting and its pad. There are no figures at present to confirm or deny this, however, the assumption is reasonable to a point.

The Institute for Environmental Research at Kansas State University is presently engaged in a study of two St. Louis elementary schools which are identical except for floor covering. A portion of this study will be concerned with heat conductance, room temperatures, human comfort, and relative costs of heating. The results of this research may prove interesting.

FUNGISTATIC AND BACTERIOSTATIC CHARACTERISTICS

A bacteriological report from a California hospital laboratory test results show that nylon carpeting is superior to hard surface flooring in remaining comparatively free from bacterial problems. The carpeting used in the experiment, and in fact installed in the hospital corridors and patients' rooms, as well as the lobby and auxiliary areas, was Commercial Carpet Corporation's "Zenith".

The maintenance procedures used are as follows:

1. The use of a wet-dry vacuum with an air-tight filter to maintain the carpet at a high level of sanitation.

2. Two per cent (2%) Lysol solution used as a disinfectant in the cleaning process, or a 1/2 per cent Phenol derivative with a Phenol coefficient of ten applied in a spray weekly.

3. Periodic spot cleaning and disinfection if necessary as accidents occur.

4. Staphine Fogging solution is used following discharge or transfer of isolation patients, in addition to the spraying of carpet with 2 per cent Lysol solution.

5. On location shampooing of carpeting is conducted by spraying moist foam including disinfectant on the carpeting, rubbing or brushing the surface, then removing with a wet or dry vacuum cleaner.

Additional tests and experiments with carpeting in hospitals are being conducted by hospitals at the present time. One such test that is within our immediate area is at Barnes Hospital in St. Louis, Missouri. No test results are available in a published form at this time.

COST STUDY

In investigating the cost of carpeting and trying to compare the cost of maintaining carpeting and resilient or any other type of flooring, difficulties are encountered. First costs in themselves vary for a multitude of reasons. All parties concerned agree, however, that carpeting is much higher in cost than resilient tile floors. Expected life of both resilient tile and carpeting will vary to a greater or lesser degree dependent upon the maintained maintenance level and traffic. Unless you can be using both materials

in the same location at the same time, you cannot arrive at an accurate comparison of expected life, and of course, this cannot normally be done.

Maintenance costs again bring in an extreme number of variables, some of which are: maintenance levels (how well are the floors going to be maintained and how do you measure this level or standard), the kind of use (entrance hall, chemistry lab, classroom, Deans' office, dormitory, etc.), the amount of traffic, and directly related to traffic, the amount of soil, the type, quality, color, and textures of the surface material being compared, and finally the maintenance practices being used on each.

In Appendix Number I you will find in tabular form some previously derived cost information. These cost figures can be discussed pro and con from here to eternity. The only real assurance that I have obtained on the cost of carpeting is by letter from the president of School Research and Service Corporation, Fullerton, California. This is the firm which installs carpeting in schools, etc., in exchange for an exclusive maintenance contract. This has been well publicized in Educational Facilities Laboratory college newsletter number 5 and other publications. The firm makes a thorough study and audit of the premises as regards to maintenance. They then arrive at an understanding of the breadth of the School Research and Service Corporation responsibilities. They state that about 75 per cent of the schools they audited could be carpeted and maintained under <u>their</u> contract with <u>no increase</u> in school operating costs. Of course, any school entering this contract which normally covers a span of five years can get a release from the contract by buying itself out so to speak at any time. A predetermined descending price scale is involved. At the end of five years the school may <u>buy</u> the carpet at a price specified in the original agreement or renew the contract.

What this does, of course, is eliminate the initial high cost problem and buys the carpeting on an installment plan at the inconvenience of contracted maintenance. The interest being paid by the school is the contracting firm's profits and overhead.

What do we as physical plant administrators gain by the installation of carpeting and the reduction in floor maintenance time for our custodial staff? Do we put it in a bank and save it? NO! We just hope it goes into better and more extensive custodial service.

I did not bother sending out questionnaires to Members of the Physical Plant Association, for without a set of standards the resultant replies would most likely not be comparable; however, over a period of time with numberous replies, a poll of institutions may be averaged to an approximate cost comparison.

At the present, it seems as though we will have to be satisfied with opinionated reports and few comparable figures.

Relatively speaking, carpeting has a higher first cost than resilient tile, carpeting will not hold up as long as resilient tile floors, but carpeting is cheaper to maintain. Whether or not it is more profitable to use carpeting instead of tile floors has not been proven sufficiently enough by anyone to date.

It seems as though we're left with a sheaf of reports which show nothing more than that cleaning costs of carpeting and tile are infinitely variable; that each case must be considered separately; that a norm is, in this instance, an abstract term to which no particular situation will conform.

MAINTENANCE

The purpose of maintenance is to retain original appearance by keeping the soil content to a minimum, and also prolong the life of the carpet. Commercial carpets are exposed to severe use. It is logical to expect a carpet installation in this service to be subject to an appreciable amount of soiling, and it will need a maintenance program related to its use. Commercial carpeting should have the attention of trained and instructed maintenance personnel. A sound maintenance program is divided into three parts: daily or routine, periodic, and seasonal.

DAILY OR ROUTINE MAINTENANCE

Daily maintenance consists of vacuuming and pile brushing. The purpose of vacuuming is to remove the soil from the carpet as well as to help to keep the pile erect. If the dirt is not removed from the carpet, it will act as an abrasive and will shorten the life of the carpet. If it is left in the pile too long, it will combine with atmospheric oils to form a film that can be removed only by shampooing. A program of frequent and thorough vacuuming postpones shampooing.

In general, two types of vacuum cleaners are available: the straight suction and commonly known tank type, and the motor driven brush and beater type combined with suction.

The tank type suction cleaner does a good job on removing dust and litter settled on the surface of the carpet, as in light traffic areas. It also is convenient for use in hard to reach places, as under counters and furniture. Often the nozzle of the suction type cleaner is equipped with a metallic or plastic comb. Although these are helpful in opening the pile of a cut pile carpet, they can snag, cut, and/or tear the face yarn of a loop pile carpet; this produces a fuzzy or beard-like surface and reduces the useful life of a carpet.

In heavy traffic areas where dirt particles have been ground into the pile, the straight suction type of cleaner is not sufficient. It is necessary to open up the pile and to remove the dirt by suction. A motor driven brush and beater type cleaner is very effective in both opening the pile and cleaning.

Where better opening and erection of pile is desired, the use of a mechanical pile brush is advisable. It is particularly useful in corridors and traffic aisles.

In general, the most efficient cleaning is accomplished with equipment having the combination of the best pile opening device and the most suction.

A good cleaning routine should consist of vacuuming the carpet daily with a vacuum cleaner. If the maintenance operation is large, the combination of a tank cleaner and the motor driven brush and beater equipment can be used to advantage. In addition to daily vacuuming, mechanical pile brushing should be used once a week in heavy traffic areas.

In general, the vacuum cleaner should be pushed slowly to enable suction to remove the soil. The carpet can be vacuumed in any direction. However, it is a good policy to finish with the final stroke in the direction of the pile lay.

PERIODIC MAINTENANCE

The scope of periodic maintenance consists of correction of mechanical damage to installations, the removal of spots and stains, and traffic area cleaning.

THE CORRECTION OF THE MECHANICAL DEFECTS

Some of the mechanical defects encountered in commercial installations are: loose ends, snags, sprouts, holes, rough seams, opened seams, loose and buckled carpet, crushing.

These types of conditions are unsightly, some are safety hazards and usually are of a kind that get worse if not given prompt attention.

Loose ends, snags, and sprouts should be clipped with scissors and never pulled. If a bare area remains, the pile yarn can be replaced by burling. Burling, or tuft replacing procedure is as follows:

Obtain matching yarns. (It's usually a good idea to have original supplier furnish several skeins of yarn with carpeting when installed.) Remove damaged tufts either with scissors or tweezers. Insert a curved needle under the shots and sew in loops. If the carpet is cut pile, make the loops higher than the surrounding tufts and then using nap scissors, trim the loops flush with the surface of the pile. When repairing loop pile the same technique is used, except that the loops are made the same height as the carpet pile.

TUFT SETTING PROCEDURE. Secure some matching yarn, remove the damaged pile, put a clear drying latex based cement into the bare spot, place the yarn in the "U" of the tuft setting needle, and with a light tap of the hammer drive the yarn into the backing of the carpet.

HOLES IN THE CARPET. Holes or other damaged areas, such as burned areas that are too large for burling, can be replaced or patched.

PATCHING PROCEDURE. With a knee-kicker, kick the carpet toward the damaged area, and stay-tack from all sides. After the damaged area is blocked in and the tension relieved, outline a rectangle or square. Using a screw driver or similar instrument, open up the nap of the carpet following the outline. Then with a sharp knife, work carefully between the opened rows of yarn and cut out the damaged area. The cut should always be made between the shots and rows of face yarn, never cut across the shot or face yarn. Check for pattern match, direction of the pile, and count the number of shots and rows when cutting out the patch.

Place faceup tape under all four sides of the cut-out. The edge of the cut-out should be on the middle of the tape. Lift the carpet at the edge of the cut-out, and apply a quality seam cement on the entire tape. Spread cement over entire tape surface and carefully coat the carpet edge. Insert the patch by forcing an awl through the center and then bend the edges downward with the other hand. When the edges of the patch are in contact with the tape, remove the awl, and push down on the center of the patch. Make certain that none of the pile is trapped between the edges. Place a weight over the patch, and allow the cement to cure.

To repair foam backed carpeting which is cemented to the floor, merely cut out the plug to be replaced, cut an identical plug from extra carpeting, apply cement to the floor back of the new plug and the carpet edges and insert the plug.

ROUGH SEAMS. This condition occurs most frequently at cross seams. Cut loops that originally were caught and hidden in the seam, work up to the surface with use. The protruding ends should be cut with nap scissors to a height slightly less than the height of the surrounding pile.

OPEN SEAMS. An open seam must be given immediate attention. It not only presents a tripping hazard but also spreads and causes damage. If the carpet is not damaged, the seam can be repaired easily. Sewn seams can be re-sewn; the taped seams require an application of cement and stay tacking. A procedure very similar to the patch procedure is used.

Stretch the carpet towards the seam and stay tack, placing nails about four inches from the center of the seam and about three inches apart. If placed over concrete, secure with sandbags. Cut the tape at the seam and remove it. If necessary, cut the carpet down the whole length of the seam, being careful not to cut across the rows, in order to prevent fraying which might occur later.

Lay sufficient face-up tape on floor for entire length of the seam and fasten it at both ends. Check fit of carpet over the tape, lift carpet, and apply a quality seam cement to about a four foot section of the tape. Also apply some of the cement to the carpet edges to lock in the tufts. Then set the carpet down on the tape and gently butt together with a knee-kicker. Then roll the seam with a porcupine roller. The tapered points of the roller perforate the carpet back and tape to improve the bond. Hold this section in place by tacking on each side of the seam about half an inch from the edge and spacing tacks about every two inches along the length of the seam. Repeat procedure for entire length of seam. Remove tacks or weights when cement has cured.

Open seams should not occur on foam backed carpeting which has been cemented to the floor.

LOOSE CARPET AND BUCKLING. If the carpet has worked loose around the doorways or the walls it should be re-fastened or buckles may develop in the carpet.

Humid weather can also cause a large installation, which has not been properly stretched, to buckle. Buckling may become hazardous and can also contribute to soiling and wear. If buckling persists, the installation should be re-stretched.

CRUSHING. This not-too-serious defect can occur in any carpet and can usually be corrected. Most carpet -- when subjected to a heavy weight such as imposed by furniture -- will become crushed. Sometimes, the pile can be restored to the upright position merely by brushing stiffly. Another method is to steam it. The steaming process consists of three steps:

1. Wet the crushed area slightly with water; cover it with two or three layers of dry, clean cloth.

2. With a hot iron (set to "wool" temperature) press down on the cloth for about 10 seconds, or until most of the steam coming from the rug has escaped.

3. With the fingers or the blade of a dull knife, brush the tufts into an erect position.

   If the pile is still crushed, repeat the process.

SPOTS AND STAINS

Commercial carpet is subjected to a wide variety of stains. These stains usually are not noticed until hours after they have occurred. This time lag increases the difficulty of their removal, and in addition to this, there is the problem of their identification.

If stain identification is possible, then use the method specifically prescribed for the removal of that type stain. If the stain cannot be identified, a "trial and error" technique, in which none of the steps interfere chemically with the subsequent steps, is used.

Although the variety of staining substances is infinite, some will respond to the same chemical treatment; this enables us to classify stains according to chemical reaction and reduce the number of removal techniques.

Generally there are three groups of stains: dry, dry-wet, and wet.

The dry type of stains respond to dry solvents and not to water.

The dry-wet type of stains is usually a combination of a water soluble substance held by a binder that is dry soluble.

The wet stains are soluble in water or a water-based solution. These wet type stains can be further sub-divided into the following groups.

a. Emulsifiable stains which are broken up mechanically and removed by the action of a detergent.

b. Digestive type stains, which are insoluble starches and proteins, must be broken down chemically or digested before they can be dissolved.

c. Yellow-brown stains are degradation products caused by aging, heat, and developed by wetting; these are frequently referred to as Tannin stains.

d. Metallic stains are usually caused by corrosion and rub off.

e. Dyes and color stains.

REMOVAL OF DRY-TYPE STAINS. Generally these spots are dark in color and collect dirt. They can feel greasy but can also be stiff. Some of the substances in this group are:

Asphalt	Furniture stains
Chewing gum	Lacquers
Cooking oils and fats	Linseed oil
Cosmetics	Machine oil and grease
Dry-type inks (Ball Point)	Oil paints
Greasy foods	Rubber and rubber cement
Furniture polishes	Shoe polishes and dyes
	Varnishes, Waxes, and Tars

Removal procedure

1. Soak with commercial dry cleaning solvent.
2. Scrape with a spatula.
3. Continue to work and absorb with tissue until the pick up ceases.

If the stain remains --

4. Use oil type paint remover. Repeat steps 2 and 3.
5. Try lacquer solvents. Repeat steps 2 and 3.
6. Use oil dye solvents. Repeat steps 2 and 3.
7. Use rubber solvents. Repeat steps 2 and 3.
   (Rubber type stains can also be removed by freezing with CO^2 or dry ice and then breaking off.)
8. Dry either with air vacuum or place a stack of tissues under a light weight and let the fabric dry.

Avoid excessive breathing of the fumes. Do not over-saturate the stain with dry solvents or a ring can result. Follow solvent manufacturer's instructions.

REMOVAL OF DRY-WET TYPE OF STAINS. The dry-wet type of stains are usually stiff or powdery and contain coloring pigments. In this class are substances such as:

Oil paints	Nail polish
Wood primers	Rouge
Wood fillers	Marking ink
Putty	India ink
Mascara	Printer's ink

Removal procedure

1. Soften the binder with the dry solvent.
2. Scrape excess with a spatula and absorb with tissue. Continue until there is no more pick up.
3. Soak with oil-type paint remover. Repeat step 2.
4. Use volatile type of paint remover. Repeat step 2.
5. Dry the spot either by vacuum or absorbent tissues.
6. Use some neutral synthetic detergent and repeat step 2.
7. Repeat step 5.

REMOVAL OF WET TYPE OF STAINS

EMULSIFIABLE STAINS. These stains are usually stiff and crusty, generally insoluble, and must be broken down into minute particles and emulsified. Some of these types of stains are:

Dirt	Lime
Clays	Plaster
Carbon black	Some paints
Building cement	Dry-type residues

Removal procedure

1. Soften with some neutral synthetic detergent.
2. Scrape the excess and gently blot with tissue until no more can be picked up.
3. Flush with tap water and repeat step 2.

If spot persists --

4. Use neutral synthetic detergent with ammonia solution. Repeat steps 2 and 3.
5. Use a wet spotter and repeat steps 2 and 3.
6. Dry either by vacuum or by using a weighted pad of absorbent tissues over the affected area.

One caution to observe is not to over-soak or spread the area.

DIGESTIVE TYPE OF STAINS. The stains that respond to digestive type treatment are usually hard, horny, and entangle the pile of the carpet. They also may have an objectionable odor. Some of these stains are:

Animal glues	Gravies
Blood	Feces
Cream	Milk
Casein paints	Ice cream
Egg	Vegetable glues
Gelatin	Vomit

Spot removal procedure

1. Pre-wet the spot with luke-warm water.
2. Apply the digester and work it in with fingers. (Digesters are available commercially.)
3. Keep adding the digester so that the spot is wet for about half an hour.
4. Flush the area with luke-warm water and absorb with tissue until there is no more pick up.
5. Use a wet spotter; work on the area and absorb with tissue.
6. Repeat step 4.
7. Dry the area.

One caution to observe is to keep the spot moistened at all times with digester, and if possible keep it warm.

TANNIN TYPE OF STAINS. The tannin type of stains are usually tan or brown color and contain no odor. Frequently these stains cannot be completely removed. Some of these stains are listed as follows:

Coffee
Tea
Beer
Wine
Liquor
Soft drinks
Coca-Cola
Fruit juices
Tobacco
Grass and leaves
Animal stains
Barnyard soil
Some inks
Some furniture polish and stains

Removal procedure

1. Wet the spot with tannin stain remover and allow it to soak for a few minutes.
2. Work the area by moistening and absorbing until there is no more pick up.
3. Flush the spot with water and absorb.
4. Soak the stain with wet soaking solution and work it into the pile. Place one-half inch thick layer of weighed down tissues over the spot and let it stand for 15 minutes. If spot remains, repeat the procedure.
5. Repeat step 3.
6. If spot persists, try steam cleaning technique.
7. Re-moisten the area with water and cover it with several layers of clean dry cloth.
8. Place a hot iron on the cloth and press down with moderate pressure until the escape of steam has nearly stopped (usually 10 seconds).
9. Repeat step 7 until there is no more pick up on the clean cloth applied to the affected area.
10. If the stain persists, use some rust remover and repeat steps 2 & 3.
11. If the stain persists, the next steps would be the bleaching. The procedure for bleaching will be discussed later.

Tannin Stain Remover

One-half ounce Glacial Acetic, 1 ounce Methyl Alcohol, 1 ounce Acetic Acid, 1 ounce Amyl Acetate, then add one-half ounce Oxalic Acid crystals and stir, then add 4 ounces Glycerin, continue stirring, while adding Butyl Alcohol until clear solution is formed.

METALLIC STAINS. These stains can be of various color and appear as powdery smears. The following fall into metallic stain type.

Iron rust (dark brown)	Red clay
Copper corrosion (green)	Brass stains (green)
Silver nitrate (blackish-grey)	Some paint residues
Argyrol	Potassium permanganate (brown)
Jeweler's rouge	

Removal Technique

1. Soak with a neutral synthetic detergent.
2. Scrape up excess and absorb with tissues.
3. Flush with water and absorb.
4. a. Use rust remover (for iron).
   b. Use 10 per cent solution of Potassium Iodide saturated with Iodine followed by 1.5 per cent Sodium Bisulfite to remove silver stains.
   c. Use 1.5 per cent Sodium Bisulfite solution followed by Acetic Acid for permanganate stains.
   d. To remove copper and brass use 7 per cent Acetic Acid.
5. Follow step 4 by absorbing and flushing with water.
6. Dry the area.

Caution: Before using these chemicals, try them on a few tufts that will be obscure when the carpet is in use. Rust remover is harmful to the skin; wash quickly if it comes in contact with your hands. The chemical used in rust remover will etch glass and metal.

DYE AND COLOR STAINS. This category includes the following substances:

Wet inks	Water colors
Medicines	Colored paper stains
Leather dyes	Bunting stains
Some furniture dyes	Bubble lights
Transfer colors	

Removal Procedure

1. Soak with neutral synthetic detergent and blot until there is no pick up.
2. Saturate with wet soaking solution. Place one-half-inch thick layer of weighed down tissues and let it stand for 15 minutes. If the spot remains, repeat the procedure.
3. Absorb and blot until no more can be picked up.
4. Flush with water and absorb.
5. Apply Acetic Acid. Repeat step 3.
6. Repeat step 1.
7. Apply ammonia solution. Repeat step 3.
8. Flush with water and absorb. If the stain persists, use:
9. Bleaching
10. Flush with water, absorb, and dry the spot.

REMOVAL PROCEDURES FOR IODINE STAINS.

1. Put sodium thiosulphate into cloth bag and saturate in 20 per cent ammonia.
2. Drip onto stain.
3. Flush out with water.
4. Blot.

OR

1. Sprinkle sodium bisulphate powder onto stain
2. Apply 20 per cent acetic acid.
3. Rinse with water.
4. Blot.

BLEACHING. If the spots do not respond to the previously mentioned techniques, they can be reduced in intensity or bleached.

The bleaching of spots is considered a last resort, because in nearly every case the carpet dyes will also be affected. If the bleaching is not controlled properly, a noticeable stain can result that frequently is more objectionable than the original stain. The area will then have to be disguised by spot dyeing, burling, or patching.

If bleaching is attempted, the following procedure is recommended:

1. Test the intensity of the bleach on some obscure area of the carpet.
2. Wet the defective area with a neutral synthetic detergent.
3. With a swab, apply onto the spot some bleach (Hydrogen Peroxide 1%).
4. If the change is too slow, the bleaching action can be accelerated by application of 7 per cent ammonia solution. Use a different swab for this purpose.
5. Arrest bleaching at the desired level by applying 7 per cent Acetic Acid with a third swab.
6. Steps 3 through 5 can be repeated, until the desired results are obtained.
7. Flush the area with water and absorb the moisture.

SPOTTING PROCEDURE FOR UNKNOWN STAINS. In the event the spots cannot be identified, the following general spotting procedure can be used:

1. Soak the spot with dry solvent.
2. Scrape and absorb until there is no more pick up.
3. Try oil type paint remover. Repeat step 2.
4. Next try special solvents for lacquer, oil, dyes, and rubber.
5. Flush and repeat step 2.
6. Dry the spot.
7. Soak the stain with tap water and repeat step 2.
8. Try digestion method. Flush and repeat step 2.
9. Use the general formula. Flush and repeat step 2.
10. Try wet spotter. Flush and repeat step 2.
11. Bleach. Follow instructions.
12. Shampoos, using neutral synthetic detergent. Repeat step 2.
13. Dry either by vacuum or by placing a stack of absorbent tissues under a weight over the spot.

There are commercial sources of the chemicals and solvents used in the above spotting procedures. Some are obtainable in a ready made carpet spotting kit form. See APPENDIX II for list of companies and products for spotting.

MAINTENANCE OF TRAFFIC AREAS

After a period of service, depending upon such factors as traffic rate and volume, the traffic lanes or areas may appear somewhat duller than the remaining carpet.

To maintain the appearance level of the carpet between overall cleaning, a localized cleaning is required.

In general, area cleaning can be accomplished by opening the pile and removing the loose dirt with a mechanical pile brush.

Sprinkle some absorbent material cleaner over the affected area. (Dry Shampoo). Brush the powder into the pile with a bristle brush. Allow it to dry thoroughly. Remove with a vacuum cleaner.

SEASONAL MAINTENANCE

Seasonal maintenance consists of "on location" cleaning of the carpet. The need will vary with traffic, air cleanliness, color, and the thoroughness of the daily maintenance. In general, if vacuuming and pile brushing do not restore the color and texture, the carpet should be shampooed.

The selection of the type of "on location" technique is influenced by the carpet face material.

For nylon carpet, the wet type method should be used. For wool carpets, hold the number of wet shampoos to a minimum and use the absorbent material (dry shampoo) method more frequently.

ABSORBENT MATERIAL METHOD OF SHAMPOOING

1. Open the pile and remove all the loose dirt from the entire area with a mechanical pile brush.
2. Pre-spot using previously described spotting techniques.
3. Sprinkle about five pounds of absorbent material uniformly over a 10 foot by 10 foot area.
4. With a mechanical absorbent powder brush, brush the powder into the pile. The amount of mechanical action will depend on the degree of soiling. In general, start with the pile lay and complete the area. Turn 90 degrees and brush the area in this direction. Turn again, and finish brushing in the direction of pile lay.
5. Repeat steps 3 and 4 for the entire area.
6. If possible, let the material dry completely (minimum of three hours.)
7. Pick up the soiled material with a vacuum cleaner.
8. Repeat step 1.
9. Repeat step 7 if necessary.

THE WET METHOD OF SHAMPOOING

The wet or detergent type of "on location" cleaning requires some judgment and skill. Every step of this recommended procedure should be followed carefully.

1. Clear the area of furniture.
2. Open up the pile and remove all the loose dirt with the mechanical pile brush.
3. Remove spots, following the previously described spotting procedure.
4. Select a starting point, usually a dead corner. Adjacent to it, place a drop cloth. Put the equipment on the drop cloth.
5. Use one bucket for water only. Mix the detergent in another bucket following the mixing directions of the supplier of the shampoo. For better cleaning results on acrylic faced fabrics, add one-half cup of Acetic Acid to a gallon of solution. In the event the situation permits, or the personnel using the space have objection to a sour odor, the regular shampooing could be followed by an additional or second shampooing using an Acidic type of shampoos such as Brown Chex or Brown X.
6. Fill the tank of the rotary brush with pre-mixed detergent.
7. With a bristle brush, hand shampoo the corners, along the wall, and around the fixtures that cannot be moved.
8. Run the rotary brush on the drop cloth until proper foaming suds form.
9. Apply the suds uniformly along one and a half times the width of the brush. Operate the brush by moving it in a small spiral. At the end of the path, cut off the detergent feed. Continue brushing and return to the starting point. Drop down about a half brush width and repeat the sudsing; cut off the feed and return. Continue this brushing pattern.
10. If one man is working alone, shampoo an area of about 10 foot by 10 foot, then vacuum immediately with wet pick-up vacuum cleaner.
11. If two men are working, one should operate the rotary brush, the other should follow the rotary brush as closely as possible with the vacuum.
12. Lay the pile with a rubber rake immediately after vacuuming, if necessary.
13. The carpet should be left to dry with minimum disturbance. The drying time varies; with proper application the carpet can dry within four hours.
14. Avoid walking or replacement of furniture on wet carpet. If it is necessary, protect pathways with sheets of paper or plastic. Place furniture on pieces of cardboard or plastic.

CAUTIONS TO OBSERVE WHEN WET SHAMPOOING. Use proper detergents. Uniform surface wetting is important. Puddling, over wetting, or soaking in spots may result in water browning. Pick up dirty suds with the vacuum immediately after the rotary brushing, or the foam will collapse and the dirt will run further down into the base of the pile. Don't walk on wet carpet. Stop and place the rotary brush on the drop cloth immediately. Never let the brush stand directly on the carpet.

SUMMARY

When selecting carpeting for purchase rely on a good carpet consultant for help in the writing of specifications and the evaluation of bids and samples. Carpeting specifications should carry a minimum and/or maximum concerning face yarns, pile, pile density, backing, underlayment, and type of construction.

Carpeting has very good acoustical properties and is thought to have good thermal insulation properties. In the only printed laboratory results obtainable, carpeting has better fungistatic and bacteriostatic characteristics than resilient tile.

In the cost field there are many arguments on both sides seemingly dependent upon who writes the article. Costs will have to be adjudged for the time being on an individual basis, relying on personal experience and common sense. As the use of carpeting becomes more pronounced in educational institutions, comparative cost information will surely become more readily obtainable.

When maintaining carpeting it should be vacuumed daily, cleaned spotted or repaired as the occasion demands periodically, and shampooed seasonally.

Perhaps the final consideration is the educator's opinion of carpeting. The majority of educators who have had any contact with carpeting are very enthusiastic as to its impetus on the teaching profession. Although seemingly unable to evaluate in any but narrative form, they are none the less enthusiastic about the effect carpeting has on the learning process. As the teaching profession accepts and then demands carpeting, more exotic fibres and the resultant longer lasting more durable carpets will be developed. These two factors alone can be paramount in placing carpeting throughout the instructional area of the physical plant of the future. This material may not be as we now know carpeting, but a soft, resilient, acoustically absorbent material of some type, whether constructed of fibres or some other type of material.

It seems very likely that a <u>soft</u> floor covering will be in our future.

APPENDIX I

COMPARISON OF FIRST COSTS OF RESILIENT FLOOR TILE AND CARPETING

	Initial Cost Per Sq. Ft.			Life Expectancy (yrs.)			Annual Cost Per M Sq. Ft.					
	American Carpet Institute	Bell System	Resilient Tile Institute	American Carpet Institute	Bell System	Resilient Tile Institute	American Carpet Institute	Bell System	Resilient Tile Institute	American Carpet Institute	Bell System	Resilient Tile Institute
CARPET	$1.20	$1.50		12	12		$100.00	$125.00				
ASPHALT TILE	.35	.25	.15	15	15	15	23.33	16.67	10.00			
VINYL ASBESTOS	.55	.40	.35	18	18	18	30.60	22.22	22.20			
VINYL	.80		.25	20	20	20	40.00		37.50			
TERRAZO	2.00	1.50		30	30		66.67	50.00				

COMPARISON OF CLEANING RATES

CARPET	Rate--Mins./M Sq. Ft.		Annual Frequency		Annual Mins. / M Sq. Ft		Average Daily Rate Mins. / M Sq. Ft.	
Spot Vacuuming	$5.19		208		1079.5		4.2	
Complete Vacuuming (upright)	18.00		26		468.0		1.8	
Stain Removal	4.13		52		214.8		0.8	
Pile Lifting	20.00		3		60.0		0.2	
Wet Cleaning (shampoo)	240.00		0.5		120.0		0.5	
Dry Cleaning (powder)	180.00		1.25		225.0		0.9	
	CARPET TOTAL				2400.8		9.3	

VINYL ASBESTOS TILE	Rate--Mins./M Sq. Ft.			Annual Frequency			Annual Mins./M Sq. Ft.			Average Daily Rate Mins./M Sq. Ft.		
Dust Mopping	5.0	5.0		260	260.0		1300	1300		5	5	
Damp Mopping	20.0	20.0	6.59	52		177.5	1040		1169.7	4		5.83
Dry Buffing	20.0	20.0		52	0.9		1040	18		4	.07	
Stripping	300.0	150.0		6	3.0		1800	450		6.9	1.73	
Spray Buffing	30.0	30.0	180.0	52		3.46	1560		622.8	6.0		2.86
Reconditioning	45.0	45.0		26			1170			4.5		
Spot Cleaning		8.0			12.0			96			.37	
		VINYL ASBESTOS TILE TOTAL					7910	1864	1792.5	30.4	7.2	8.69

TERRAZO	Rate--Mins./M Sq. Ft.		Annual Frequency		Annual Mins./M Sq. Ft.		Average Daily Rate Mins./M Sq. Ft.	
Dust Mopping	5	5	260	154	1300	770	5.0	3.0
Damp Mopping	20	20	104	52	2080	1040	8.0	4.0
Wet Mopping	30	30	52	52	1560	1560	6.0	6.0
Dry Buffing	20	20	52		1040		4.0	
Light Machine Scrubbing	60	60	6	2	360	120	1.4	0.5
Sealing--Temporary	180		2		360		1.4	
Sealing--Permanent	300		1		300		1.2	
	TERRAZO TOTAL				7000	3490	27.0	13.5

COST OF CAPITAL EQUIPMENT

CARPET		
Small Wand Type Vacuum	$168.50	$87.00
Industrial Upright Vacuum	137.95	150.00
Floor Scrubbing Machine	133.75	315.69
Carpet Repair Kit	5.00	5.00
Professional Spitting Kit	35.00	35.00
Pile Lifter	379.00	379.00
TOTAL	859.20	971.69

TILE AND TERRAZO			
Wet Pick-up Vacuum	$337.00	$184.91	
Floor Machine, 19" w/tank	401.25	315.69	300.00
Scrub Brush	17.00	14.10	3.32 (pad)
Baseboard Cleaning Mach.	289.00		
Two 32 qt. Stainless Buckets	98.20		
Two 32 qt. Galvanized Buckets		24.00	
Two Ind. Type Wringers	44.50	20.00	33.00
TOTAL	1186.95	558.70	336.32

EXPENDABLE SUPPLIES--COST/M SQ. FT.			
Carpet	$5.33	$25.65	
Vinyl			
Asbestos	49.67	12.23	8.92
Terrazo	27.14	6.76	

OVERALL COST COMPARISON	CARPET			VINYL ASBESTOS		
Covering Annual First Cost $/M Sq. Ft.	$100.00	$125.00		$30.60	$22.22	$22.20
Expendable Supplies Annual Cost $/M Sq. Ft.	5.33	25.65		49.67	12.23	8.92
Labor (assuming 100 Min/$1) Annual Cost $/M Sq. Ft.	24.00	assume 24.00		79.10	18.64	17.92
Ammortization of Capital Equipmen over 10 yrs.	85.92	97.17		118.70	55.87	33.63
Total Ann al Cost/M Sq. Ft.	215.25	271.82		278.07	108.96	82.67

APPENDIX II

Companies offering Carpet Spotting Chemicals

Burke-Schier, Chattanooga, Tennessee

Carolyn Chemical Co., 1987 E. Main Street, Columbus 5, Ohio

Certified Chemical & Equipment Co., 1472 E. 25th Street, Cleveland 14, Ohio

Diamond-Alkali Co., 300 Union Commerce Bldg., Cleveland 14, Ohio

Duo Dellay Products, 4201 Pulaski Highway, Baltimore 24, Md.

Hild Floor Machine Co., 740 West Washington Boulevard, Chicago 6, Illinois.

Host-Racine Industrial Plant Inc., 1405 Sixteenth Street, Racine, Wisconsin

J. G. Chemists, Murray, Kentucky

The Kent Co., Inc., Rome, New York

Keystone Analine & Chem Co., 321 N. Loomis Street, Chicago 7, Ill.

Multi Clean Products Inc., St. Paul 16, Minn.

National Super Service Co., Toledo 2, Ohio

N. I. R. C., 7355 Wisconsin Ave., Bethesda 14, Md.

Pennsylvania Salt Mfg. Co., 1000 Widener Building, Philadelphia 7, Pa.

Reiling Mfg. Co., P. O. Box 103, 8514 Verona Road, Battle Creek, Michigan

Roberts Co., 600 North Baldwin Park Blvd., City of Industry, California

Stamford Chemical Co., Stamford, Conn.

R. R. Street Co., 561 W. Monroe Street, Chicago 6, Ill.

Wade, Wenger Service Master Inc., Downers Brove, Chicago 14, Ill.

Warco Laboratories, 13609 South Normandy Ave., Gardena, California

A. L. Wilson Chemical Co., 38 Passaic Avenue, Kearney, N. J.

J. Wolf & Co., Box 389, Passaic, N. J.

Zimmerman Products, 2519 Burnet Avenue, Cincinnati, Ohio

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*Excellent Reference Material on Carpeting, Cost Comparison, and Carpet Maintenance

GLOSSARY

BEARDING -- The long fiber fuzz on loop pile fabrics. Caused by fiber snagging and inadequate anchorage.

BUCKLING -- A carpet that does not lay flat on the floor and contains ridges.

BURLING -- Removing from a carpet any extraneous substance such as knots, loose threads, slubs, burrs, and defects to produce acceptable quality after weaving. Also, filling in any omissions.

CONSTRUCTION -- The method by which the carpet is made; i.e., loom type, pile rows per inch, pitch, wire height, shots face frames or harnesses, draw, yarn count, face yarn weight, stuffers, kind and quantity of backsize, and total carpet weight.

COUNT -- A number identifying yarn size or weight per unit of length or vice versa depending on the particular system being used.

CUT PILE -- A fabric, the face of which is composed of cut ends of pile yarn.

DENIER -- A system of yarn count used by synthetic fiber industry. One denier equals 4,464,528 yards per pound or 279,033 per ounce. To find the yards per ounce divide 279,033 by the denier number.

DENSITY HEIGHT -- The square of the density multiplied by the pile height; a criterion by which the potential wear life of different carpet grades can be compared theoretically. The assumption is made in the use of this criterion that the fibers in the materials being compared are of equal quality, and all other factors are constant. For example, if a carpet has a density of 32 and a pile height of .25 inches, a 25 per cent increase in the pile height would mean a corresponding 25 per cent increase in the durability of the carpet. However, if the density of the carpet were increased by 25 per cent, the durability would have been increased by 66 per cent.

FILLING -- (Same as WEFT) -- Yarns of cotton, jute or kraftcord running across the fabric and used with the chain yarns to bind the pile tufts to the backing yarns.

FLUFFING OR SHEDDING -- A condition of shedding the short fibers or lint (fuzz), which remain in the surface of any new fabric, after cutting and shearing. It is a normal phenomenon, and the fuzz can be easily picked up into a vacuum cleaner. Fluffing does not damage the carpet and in time will disappear.

FUZZING -- Hairy effect on fabric surface caused by wild fibers or slack yarn twist, by fibers slipping out of yarn or contour in either service or wet cleaning. Carpet made of continuous filament yarn is fuzzed by filaments snagging and breaking. It is corrected by shearing.

JUTE -- The fiber obtained from the inner bark of a tall, slender-stemmed Asiatic herb. It is shredded and spun into strong, durable yarns which are used as "stuffer" and "filling" yarns to give bulk, strength and stiffness to the carpet backing.

KRAFTCORD -- Tightly twisted yarn made from special strength Kraft paper. Provides bulk, stiffness, clean non-hairy back at an attractive cost. Used as an alternate for cotton or jute in the carpet back.

PADDING -- A cushion material used under rugs and carpets made of non-woven cattle hair, jute, waste fibers, rubber-sponge and foam, foamed plastics and assorted combinations of the materials.

PILE -- the raised loops or tufts, cut or uncut, on the surface of the carpet.

PILE HEIGHT -- The height of pile measured from the top surface of the back to the top surface of the pile.

PILLING -- Formation on the carpet surface of bunches or balls of tangled fibers which cannot be removed without breaking a fiber.

PITCH -- The number of warp yarns per inch of width, visible on the back, usually expressed in relation to the standard 27-inch width.

PLY -- One strand of yarn thickness. Term used to designate the number of strands of wool or worsted used in the finished yarn and is designated as one, two, three or four ply.

SELVEDGE OR SELVAGE -- The edge of the woven carpet that will not ravel or require binding or serging.

SERGING -- A method of finishing a cut edge of carpet by "oversewing". It is customary to serge the sides and bind the ends.

SHADING -- Bending or crushing the surface fibers so that the sides of the fiber reflect the light. Viewed from one direction of the rug or carpet, the crushed area will appear darker in color; from the opposite side it will seem lighter. However, it is to be pointed out that the phenomenon of shading is inherent and characteristic of all pile fabrics and is not a defect.

SHOT or PICK -- Refers to the number of filling yarns (weft yarns) shuttled across the fabric in relation to each row of pile tufts.

SHOOTING or SPROUTING -- Individual strands of yarn protruding above the surface of the pile. These may be extra long ends of tufts which were not sheared at the mill; pieces of backing material which have risen above the surface; loose ends which were not secured firmly; or occasionally the untwisting of the tightly twisted tufts in a twist weave carpet. This condition of sprouting or shooting does not mean that the fabric is coming apart; for it does no damage. It is only necessary to clip or shear these loose ends even with the pile surface. The sprouting yarns should not be pulled out.

STUFFER -- Extra warp ends that lie in a plane between the face and the back of the cloth and do not intertwine with any filling ends. Serves to give weight, thickness, and stability to the fabric.

WARP -- A series of threads or yarns running lengthwise in the carpet. Usually consists of chain, stuffer, and pile warp.

WEFT -- The yarns thrown by the shuttle through the warp from selvage to selvage.

YARN WEIGHT -- Number of yards of yarn per unit of weight.